a good means of determining the existence of Hypermetropia, Myopia, Astigmatism, and other affections of the retina of the eye, and seem to us to be well adapted for the purpose for which they are intended. H. P.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his Correspondents. No notice is taken of anonymous communications.*]

Thickness of the Earth's Crust—Mr. Hopkins and M. Delaunay

In your numbers for March 16 and 23, 1871 (pp. 400, 420) you give brief notices of the proceedings of the Academy of Sciences in Paris on the 6th and 13th of that month, from which it appears that Mr. Hopkins's method of determining whether the crust of the earth is thick or thin has been again under discussion there. In the latter of these notices M. Delaunay observes that he had been anticipated in his objections by Mr. Hennessy.

It so happens that Mr. Hopkins sent to me in Calcutta in 1858 a copy of Mr. Hennessy's paper (which was published in the *Philosophical Transactions* of 1851) with his remarks in writing in the margin; and I think it will be interesting to your readers if I give Mr. Hopkins's opinion of the paper.

Mr. Hennessy remarks (p. 546) that Mr. Hopkins's "result was founded on the hypothesis of the non-existence of friction and pressure from molecular causes at the surface of contact of the shell and nucleus." On which Mr. Hopkins writes:—"This is not correct. My hypothesis is the absence of friction between the fluid particles themselves."

Again, Mr. Hennessy considers, as a result of his calculation, "that we are entitled to assume that the motion of rotation of both shell and nucleus takes place nearly as if the mass were entirely solid." On which Mr. Hopkins observes: "Nothing could justify the assumption of a mechanical impossibility." And he traces this erroneous conclusion to the fact that Mr. Hennessy has made two assumptions in the course of his calculations which vitiate it throughout, viz., (1) that the axes of instantaneous rotation of the shell and nucleus would coincide (which is implied in the last formula in par. 2. p. 514), "which," wrote Mr. Hopkins, "they certainly would not," and (2) that "the shell (or crust) is rigid" (p. 519, 525) so as to resist, without change of form, the internal pressure which arises from the inner surface, that is, the surface of the nucleus, ceasing to be a surface of equilibrium, which Mr. Hopkins very reasonably considers to be quite inadmissible, and that accordingly the results deduced from these assumptions are "valueless."

2. I will take this opportunity of reverting to my letter to you of April 10, 1871. I there point out that what Mr. Hopkins did consists of two parts—(1) his conception of the idea that as the crust is not solidly connected with the fluid nucleus the amount of precession must depend in some measure upon the thickness of the crust; and (2) his *calculation* of the amount of precession this idea would lead to, so that by comparison with observation the thickness might be approximately found. In this way he discovered that if the crust and nucleus were homogeneous, and of the same density (which they are far from being), the inner and outer surfaces of the crust being similar and similarly situated spheroids, the internal pressure of the fluid would act so as to leave terms in the precession depending on the thickness of the crust, only of the second order of small quantities; whereas, in the case of the earth where the mass is heterogeneous, the mean density being double of the superficial density, the thickness is involved in terms of the first order in the expression for the precession, and by a comparison with observation leads to Mr. Hopkins's result, viz., that the thickness is very great, something like 800 or 1,000 miles at least.

Calcutta, May 24 John H. Pratt

The Duties of Local Societies

It is undoubtedly the work proper to local natural history societies to study well the productions of their own immediate neighbourhood, to catalogue all the fossils, plants, and animals, and to note any peculiarities regarding them. In the settlement of the great questions still under discussion, much will depend upon their faithfully performing this duty. All naturalists will cordially endorse whatever has been said in regarding such societies from this point of view, and will agree in declaring that it is far better they should be occupied in such labour than in the discussion of theories and abstruse general questions, which are better left to larger and more influential bodies. It is their office to collect facts upon which individual minds may generalise. This of course applies to such bodies in their collective capacity, and not to the members as individuals; it is very probable that such individuals may make use of the facts collected by the society.

But it should also be remembered that local societies have another duty to perform, and one, too, of hardly secondary importance, and that is the inculcation of the love of natural history in other minds. Indeed, it will often be found that for a time at least this must take precedence of the work already mentioned. It is well known to all who have taken any active part in field clubs and the like, that the real work devolves upon two or three members, sometimes fewer still, and it is totally beyond the power of these two or three to work up the whole natural history of the district by themselves; they may have the will and the ability, but neither the time nor the means. We have known societies numbering above a hundred members where this was the case; the great majority could not be called working members at all; they joined for various reasons, some merely because it was rather "the thing" to do in the town or village; the greater number probably because they were interested in seeing specimens, hearing pleasantly-written papers at meetings, highly delighted at microscopical conversations, &c., &c., but did not care about working in the subjects for themselves. It is very evident that in such cases the first and foremost aim should be to induce as many as possible to become students of nature, at least to enable them to make intelligent notes of what they observe. Hence we find that the reports of provincial societies occasionally appear with little addition to what is already known, very little local information in them, and though this is to be greatly regretted (and in reality is so by the editors), it should not be regarded, as it often is, merely as matter of reproach by others more advanced. Local magazines and reports are issued mainly for the perusal of the members and others living in the locality, and such persons naturally wish to see the best of the papers that have been read; and the matters that interest them most are not always new discoveries, wherever they may be made.

But besides the ordinary method of reading papers at meetings principally, if not solely, attended by members, there are others to be followed by way of inducing outsiders to join the society. One is that of "Penny Rambles," which has been very successful in some localities. These should be conducted by some one not only well versed in natural history, but gifted with the not common ability to impart his knowledge in an attractive and popular way. There should be a change of conductors as often as possible, but care ought to be taken always to secure good ones, as one disappointment lasts a long time; this implies that some competent person or committee should have the control over the arrangements. Sometimes it will be found that one man makes himself so well understood, and consequently so attractive, that he is preferred to others, and here the *vox populi*, within due limits, should have weight. As for subjects, no naturalist will ever be at a loss: the geology of the neighbourhood, some quarry, sand pit, or sea beach; the botany, some of the rarities and their peculiarities; entomology also, and an occasional chat about some interesting antiquity in the vicinity. No abstruse theories should be taken up, they may be intensely interesting to the real naturalist, but are in a general way unknown, and if known, unappreciated by the multitude.

The science lectures, lately so admirably carried out at Manchester, and already referred to in these pages, will occur at once to every one; they might well be taken up in all large towns. But could not Museum Lectures also be started? The duty of every local society to establish a museum has been ably argued by another pen—a museum not for its own sake merely, but with this secondary idea before them, the good of the town or village in which they may be located; one in which the labouring man shall find displayed specimens of the wealth of his own neighbourhood, as well as typical forms from far off lands. Prof. Huxley has well said in one of his "Lay Sermons" that there is a general impression among people that every event of importance happened a long time ago; it is equally true that they fancy any natural object worth looking at must be sought for a long way off; it is our duty to eradicate both impressions. If some plan could be adopted of giving penny lectures in the Museum, it would

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greatly add to the interest excited; it would assist people to understand what they see, and tend to the destruction of that languid curiosity so painfully evident in the faces of sightseers. The contents of one case would serve for one or two lectures, and those who listened would necessarily carry away a few new ideas.

We have been viewing the question solely from its popular side, being convinced that it is of great importance; other plans may occur to the reader, and may be well worthy of ventilation.

HENRY ULLYETT

Colour

SINCE the publication in NATURE of my paper on "Colour," I have received several inquiries for references on the subject. These I should have given at the time, only that I wrote away from books; perhaps on the principle of "better late than never," the publication in NATURE of the following selection may save trouble to some interested in the matter.

Helmholtz: "Ueber die Theorie der zusammengesetzten Farben;" "Poggendorff's Annalen," lxxxvii. p. 45; "Philos. Magazine," (4) iv. p. 519.

Maxwell: "Experiments on Colour perceived by the Eye, with Remarks on Colour Blindness;" "Edinburgh Transactions," xxi. p. 275.

Maxwell: "On the Theory of Compound Colours, and the Relations of the Colours of the Spectrum;" "Phil. Trans.," 1860.

Maxwell: "Account of Experiments on the Perception of Colour;" "Phil. Mag." (4), xiv. p. 40.

Müller: "Zur Theorie der Farben;" "Pogg. Ann" vol. 139, p. 411.

These are the principal original memoirs. Of books on colour there are very few that can be trusted. Benson's "Principles of the Science of Colour" is recommended by Prof. Maxwell. There is also a tolerably complete exposition of the subject in Helmholtz's "Physiologische Optik," of which excellent work a French translation has, I believe, been published.

Have any of the readers of NATURE tried a double image prism for exhibiting the mixtures of two colours? By the aid of a Nicol the proportions of the components may be varied at pleasure, and the combination is, in my experience, more effective than the plate of glass referred to in the books. However, on account of the texture of the coloured papers or wafers, the mixture is not so perfect as that obtained by rotation.

J. W. STRUTT

A Hint to the Longsighted

A SMALL optical expedient which has been of service to me may be new to some of your readers, and useful, on occasion, to those among them whose sight is as long as my own. The focal length of the convex lens I require for my right eye in reading is twelve inches, and I find that by holding a lens of 30-inch focus about a foot from this eye I am enabled to see distant objects not only with singular distinctness, but also perceptibly magnified. I can read moderate-sized print at the distance of twelve feet, and make out the details of a church tower half a mile off nearly as well as with a small opera glass magnifying two and a half times. The greater the distance of the lens from the eye the greater is the magnifying power; but beyond a certain point (depending on the focus of the lens and the distance of the object) the gain is more than neutralised by the loss of distinctness with eyes that deviate but slightly from the normal standard, the lens employed must be so weak that the gain is inappreciable.

I presume that a lens thus held at a distance from the eye, like the German "Stöpfel Linse" described by Sir John Herschel, "realises the notion of Descartes as to the mode of action of a telescope, which he regarded as an enlargement or prolongation of the eye. For the natural cornea we substitute an artificial one, which is more remote from the retina, and so forms there a larger image."

W. T. RADFORD

Lignite and Selenite

WILL you kindly allow me to inquire whether any of your readers can inform me if there exists any connection between lignite and selenite when found together, and, if so, in what way the lignite assists in the formation of the crystals of calcium sulphate.

I have recently found selenite in three or four different places, and in each case associated with lignite, viz., in the Bracklesham Beds near Stubbington, in the Woolwich Beds at Dulwich, and in ochrey clay near Lewisham Chalk Pits.

June 19 AN AMATEUR

Arctic Auroras

IN answer to your inquiry, I send you the following information on a Northern Light observed at Kooltook, S.W. end of the Baikal Lake, by Dr. Dyhoffsky. It is taken from a source doubtless not at your disposition (Bulletin of the Siberian section of the Geographical Society, 1871, No. 2):—

"On October 24 (1870) evening a northern light was observed at Kooltook. It began at 9 P.M. with a red light, which appeared more and more distinctly from behind the mountains that border the landscape on the north. It was a little towards the east from the magnetic meridian. This light now increased in the form of a column, now diminished, and at times seemed to vanish entirely. After nearly an hour of such waverings, the light gradually began to increase and get broader; at midnight it reached its utmost intensity and development.

"Its least limits on the horizon were included between N. 59° E. and N. 45° W. Six columns were distinctly visible at midnight, reaching half the distance between the horizon and the zenith, the middle column was the brightest and highest, but at the same time the narrowest, and bordered with reddish-yellow. The other columns were less brilliant but far broader. When the middle column decreased, the western one began to increase, though it never reached the intensity of the middle column. The other columns also increased and diminished by turns; then the phenomenon gradually fainted away, and at three o'clock there remained but a ruddy light, which now, as at the beginning, was brighter towards the east of the meridian."

The same aurora was observed at different localities of Europe.

P. KROPOTKINE

Catherine Channel, Petersburg, May $\frac{13}{20}$, 1871

Day Auroras in the Arctic Regions

I CAN now answer Dr. Burder's question regarding the appearance of the Aurora Borealis in the Arctic Regions. The other evening (last Thursday) I had a conversation with a distinguished magnetician and Arctic explorer, and he informed me that he has often seen the Aurora in *broad daylight* in those regions, the colour invariably being crimson. This, I hope, will once for all settle the apparently vexed question (*pace* Dr. Burder) of "alleged" daylight Auroras. Not to repeat the entire "crusher" of Dr. Burder's, I think many will now discard as "unworthy of serious criticism" his cirrus-cloudy arguments. He must pardon me for being so unceremonious, and remember his own interesting way of confuting—or, better, his attempt.

JOHN JEREMIAH

SCIENCE IN PLAIN ENGLISH

I.

IN tracing the development of public opinion, no period is more instructive than the last three hundred years; and at present the review is particularly important, for we seem to be in a position analogous to the state of Europe just before the Revival of Classical Learning. We are evidently on the eve of great changes in principle, and one vital question is to consider the value of classical culture as compared with the study of science.

The distinctive work of the thirty years (1820-1850) was to "diffuse useful knowledge" among the middle classes. Beside the establishment of mechanics' institutions throughout the country, the London University was founded in 1828; and the British Association for the Advancement of Science held its first annual meeting at York on September 27, 1831, under the presidency of Earl Fitzwilliam.

Another agency has been brought into action, more especially directed to the practical arts, and bringing into friendly competition the various nations of Europe. The International Exhibition of 1851 had a remarkable in-

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